Energy Conservation in buildings: The Role of Policy and Market Forces

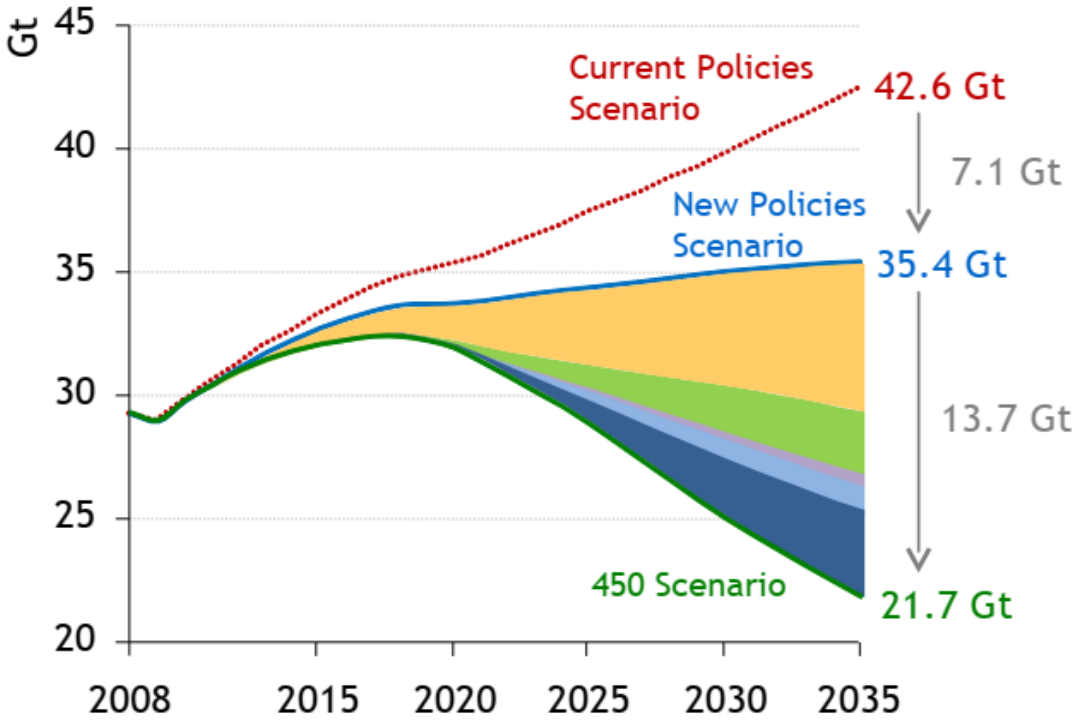
Rajkiran Bilolikar, Administrative Staff College of India

SAARC Workshop

"Techniques on Energy Conservation and Efficiency in Buildings"

Dambulla, Sri Lanka | 26 – 28 August 2019

World CO_2 Emission Savings



Share of cumulative abatement between 2010-2035	
Efficiency	50%
Renewables	18%
Biofuels	4%
Nuclear	9%
CCS	20%

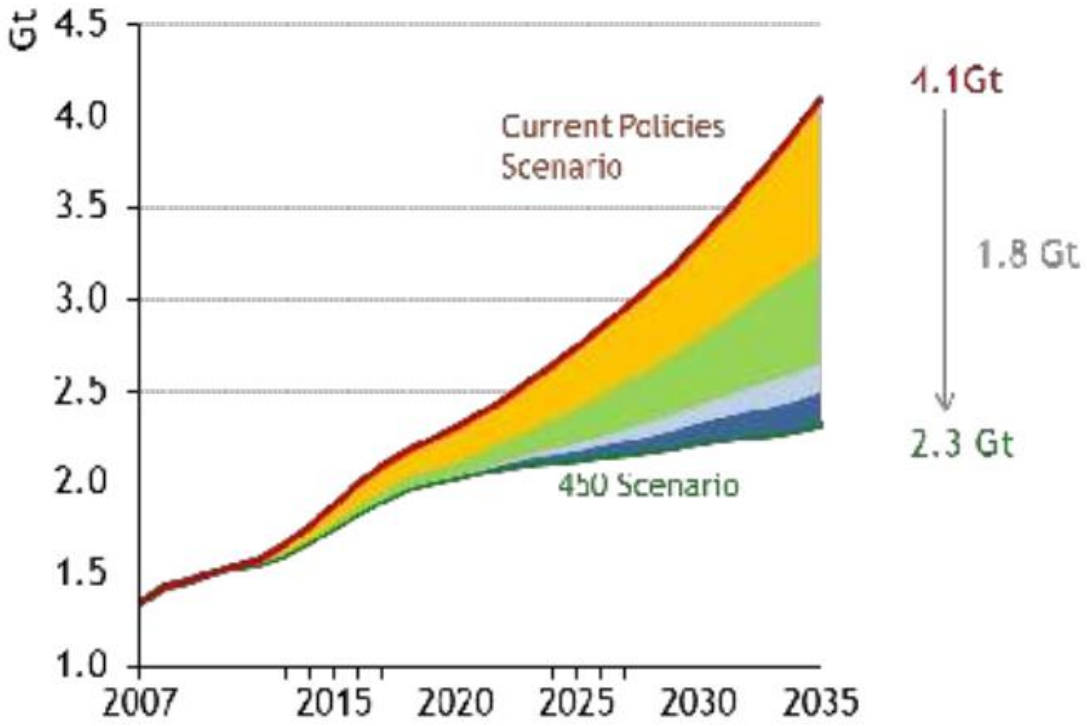
Source: WEO 2010

New Policies Scenario is the central scenario in WEO-2010

> assumes cautious implementation of recently announced commitments & plans, even if yet to be formally adopted

The 450 Scenario sets out an energy pathway consistent with the goal of limiting increase in average temperature to 2°C

India – CO_2 Emission Reduction



Share of cumulative abatement between 2010-2035	
Efficiency	51%
Renewables	32%
Biofuels	1%
Nuclear	8%
CCS	8%

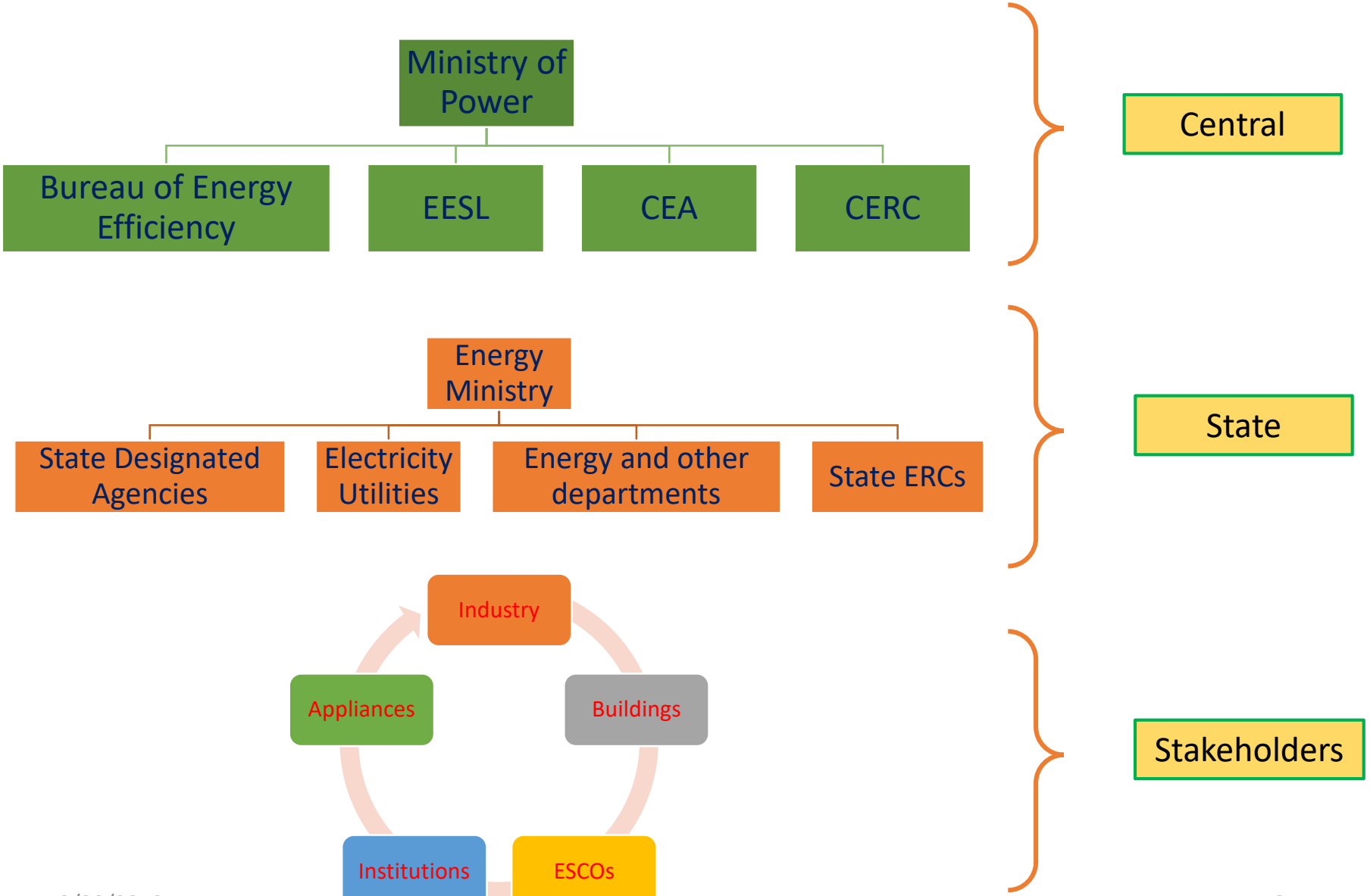
Need for Energy Efficiency

- India needs to sustain a GDP growth rate of over 6% per annum over the next two to three decades in order to eliminate poverty
- Energy consumption will need to grow at a commensurate pace for such a GDP growth
- *With Energy Efficiency, we could save 500 BU of energy and avoid the need of 100 GW of power by 2030 – This translates to 557 MT of CO2 emissions – Abhay Bakre, DG, BEE*
- The need for efficient use of resources, energy conservation assume significance and must be an integral part of the policy tools

Energy Conservation Act 2001

- An Act to provide for efficient use of energy and its conservation and for matters connected therewith or incidental thereto
- It extends to the whole of India
- It was enacted by Parliament in the Fifty-second Year of the Republic of India on October 2001
- The Bureau of Energy Efficiency (BEE) came into force from March 2002 onwards

Energy Efficiency Implementation Structure in India



Powers of Central Government

- Specify the norms for processes and energy consumption standards for any equipment, appliances which consumes, generates, transmits or supplies energy
- Specify equipment or appliance or class of equipments or appliances, as the case may be, for the purposes of the proposed legislation
- Prohibit manufacture or sale or purchase or import of equipment or appliances unless such equipment or appliances conforms to energy consumption standards
- Direct display of such particulars on label on equipment or on appliance

Powers of Central Government….

- Specify, having regard to the intensity or quantity of energy consumed by any user or class of users of energy as designated consumer for the purposes of the legislation
- Direct any designated consumer to get energy audit conducted by an accredited energy auditor
- Direct designated consumer to appoint energy manager in charge of activities for conservation of energy
- Prescribe minimum qualifications for appointment of energy managers

Powers of Central Government….

- Direct any designated consumer to furnish information with regard to energy consumed and action taken on the recommendation of the accredited energy auditor
- Direct any designated consumer to prepare a scheme for efficient use of energy and its conservation and implement such schemes as may be prescribed
- Prescribe energy conservation building codes for efficient use of energy and its conservation in the building or building complex

Powers of Bureau of Energy Efficiency

- Recommend to the Central Government the norms for processes and energy consumption standards for equipment and appliances
- Recommend to the Central Government for notifying any user or class of users of energy as a designated consumer having regard to intensity or quantity of energy used by it
- Recommend to the Central Government the particulars required to be displayed on label of equipments or on appliances and manner of their display
- Take suitable steps to prescribe guidelines for energy conservation building codes

Powers of Bureau of Energy Efficiency..

- Develop testing and certification procedure and promote testing facilities for certification and testing for energy consumption of equipment and appliances
- Promote use of energy efficient processes, equipment, devices and systems
- Specify qualifications for the accredited energy auditors, the manners and interval of time in which the energy audit shall be conducted by such auditors
- Specify certification procedures for energy managers to be appointed by designated consumers

Powers of Bureau of Energy Efficiency..

- Prepare educational curriculum on efficient use of energy and its conservation for educational institutions, boards, universities or autonomous bodies and coordinate with them for inclusion of such curriculum in their syllabus

Powers of State Government

- Amend the energy conservation building codes to suit the regional and local climatic conditions
- Direct every owner or occupier of a building or building complex being a designated consumer to comply with the provisions of the energy conservation building codes

- Telangana and AP has amended the ECBC to suit the local climate and incorporated in local building rules
- For all non residential or commercial buildings that have plot area of 1000 m^2 or built up area of 2000 m^2 and certain categories of buildings such as hotels, multiplexes, hospitals and convention centres irrespective of built up area

Powers of State Government……

- Direct if considered necessary for efficient use of energy and its conservation, any designated consumer to get energy audit conducted by an accredited energy auditor in such manner and at such intervals of time as may be specified by regulations

- BEE has issued directions to include Hotel buildings as designated consumers in PAT cycle IV. The Taj Krishna has been notified as designated consumer for the first time in the state

- TSREDCO which is State Designated Agency is monitoring PAT scheme for the DCs in the state in seven sectors covering pulp and paper, thermal power plant. Cement, textiles, iron and steel, DISCOMS, Hotels and Railways

- Office Buildings and District Integrated Collector complexes

Readiness for Energy Efficiency

Sector specific action plan for scaling up energy efficiency efforts	Mandates for utilities to invest in energy efficiency	Mandates for public institutions to invest in energy efficiency
Adoption of legislation, policy or sector-specific action plan	Mandates for compliance with energy efficiency Penalties for noncompliance	Obligations for procurement of energy efficiency end use applications
Quantified energy efficiency goals or targets	Notification of DSM regulations	Adoption of energy conservation awards
	Notification of guidelines on cost effectiveness and M&V	
	Mandate for establishment of DSM cells within Distribution Utilities	
	Incentives for demand response (e.g., peak-time rebates)	
	Mandate for integrated resource planning	
Incentives for MSMEs to invest in energy efficiency	**Incentives for large scale users (industry/commercial) to invest in energy efficiency**	**Implementation of energy conservation building codes**
Incentives to invest in energy efficiency	Incentives to invest in energy efficiency	Status of adoption of ECBC
Programmatic assistance to identify energy savings investment opportunities	Programmatic assistance to identify energy savings investment opportunities	Type of buildings and building renovation covered for ECBC compliance
		Availability of standardized rating system (certification) for qualifying the energy performance of buildings
		Incentives for individual buildings to meet high quality energy efficiency certifications

Readiness for Energy Efficiency

Information or tools available to consumers on electricity usage	Energy efficiency potential and implementation experience	Financing mechanisms available for energy efficiency investments
Bills with energy usage information Customised bills comparing previous energy consumption Customised bills comparing with other users in the same region and/or usage class	Distribution of LED lamps among households	State Energy Conservation Fund (SECF)
Customer access to real-time energy usage data	Upgrading of agriculture pumpset efficiency	Capital subsidy for energy efficiency programs
Customer ability/control to manage energy usage remotely	Adoption of LED technology for street lighting applications	On-bill financing/prepayment
	Distribution of BEE star rated household fans	Credit lines with banks for energy efficiency activities
	Implementation of solar irrigation pump program	Energy services agreements (pay-for-performance contracts)
	Transmission & Distribution losses (%)	Partial risk guarantees
	Peak power deficit (%)	Cost recovery through ARR/tariffs
	Electrical energy deficit (%)	DSM funds created by levy/cess
		Others

Readiness for Energy Efficiency

Institutional framework and capacity	Monitoring and evaluation systems
Dedicated entity for formulating energy efficiency strategy/policy	Monitoring / tracking system for energy efficiency targets / performance indicators for Utilities
Dedicated entity for regulating energy efficiency activities of energy suppliers	Independent validation of energy efficiency targets / performance indicators by third parties
Dedicated entity for regulating energy efficiency activities of energy consumers	Tracking utilities' compliance with for providing energy usage information to customers by regulator
Dedicated entity for regulating equipment energy efficiency standards	Load research studies conducted by the utilities to plan for DSM programs
Dedicated entity for enforcing / certifying compliances with building energy efficiency standards	Empanelment mechanism for energy consultants and auditors
	Compliance monitoring system for ECBC
	Independent verification of ECBC compliance by third parties

Context

Building energy codes represent a significant savings opportunity for U.S. home and business owners. Model energy codes[1] for residential and commercial buildings are projected to save (cumulative 2010-2040):

- **$126 billion** energy cost savings
- **841 MMT** of avoided CO_2 emissions
- **12.82 quads** of primary energy

These savings equate to the annual emissions of:

- 177 million passenger vehicles
- 245 coal power plants
- 89 million homes[2]

Indian Context -

From 400 towns – to 2000 cities by 2050 in India[1]

India will add 1 billion m^2 of new commercial building space by 2030 - BEE

With Energy Codes (ECBC)

- ❑ 90014 Gwh savings potential in new buildings by 2030
- ❑ 8700 Gwh savings potential in existing buildings

By adopting ECBC 2017, BEE predicts

- ❑ 300 BU Energy Savings
- ❑ 15 GW Peak Demand Reduction
- ❑ 250 mtCO2e GHG Abatement
- ❑ Rs. 35000 Crores Savings

Energy Conservation Building Code (ECBC)

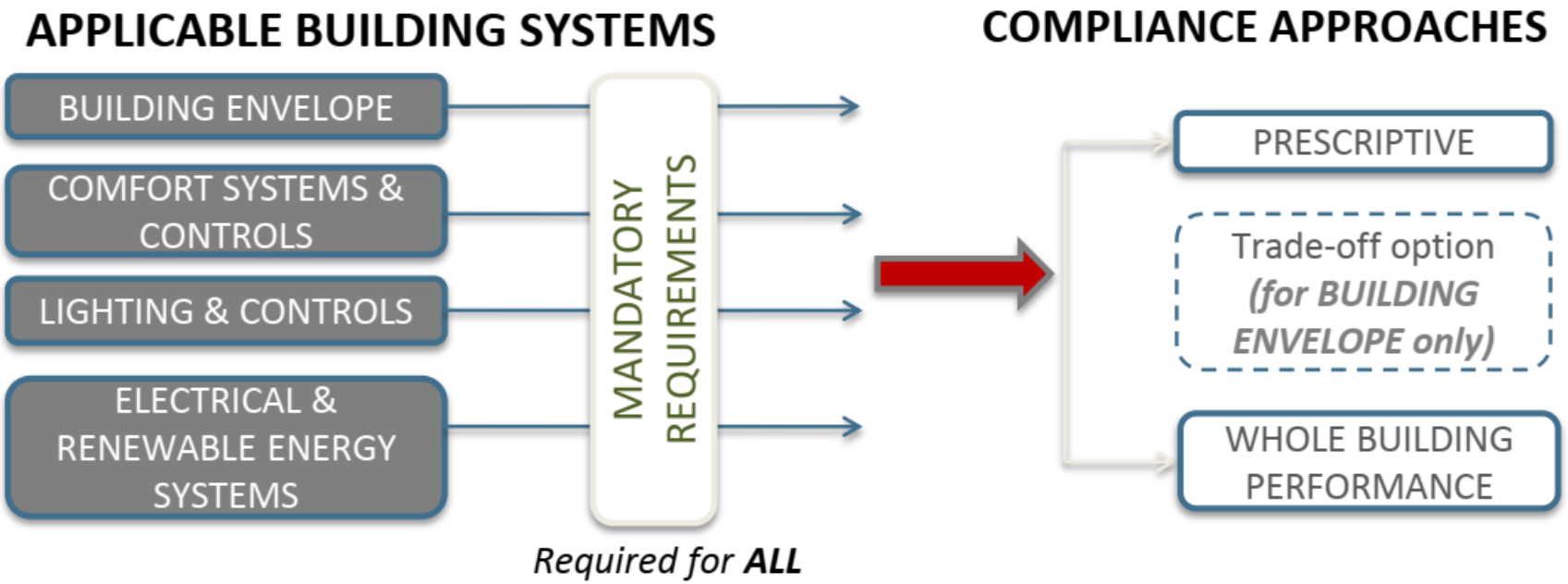
- **Energy Conservation Building Codes (ECBC)**
  - Minimum energy efficiency standards
  - Applicable to large commercial buildings
  - (connected load of 100 kW/contract demand of 120 kVA and above)

- **ECBC prescribes standards for:**
  - Building Envelope (Walls, Roofs, Windows)
  - Lighting (Indoor and Outdoor)
  - Heating Ventilation and Air Conditioning (HVAC) System
  - Solar Water Heating
  - Electrical Systems

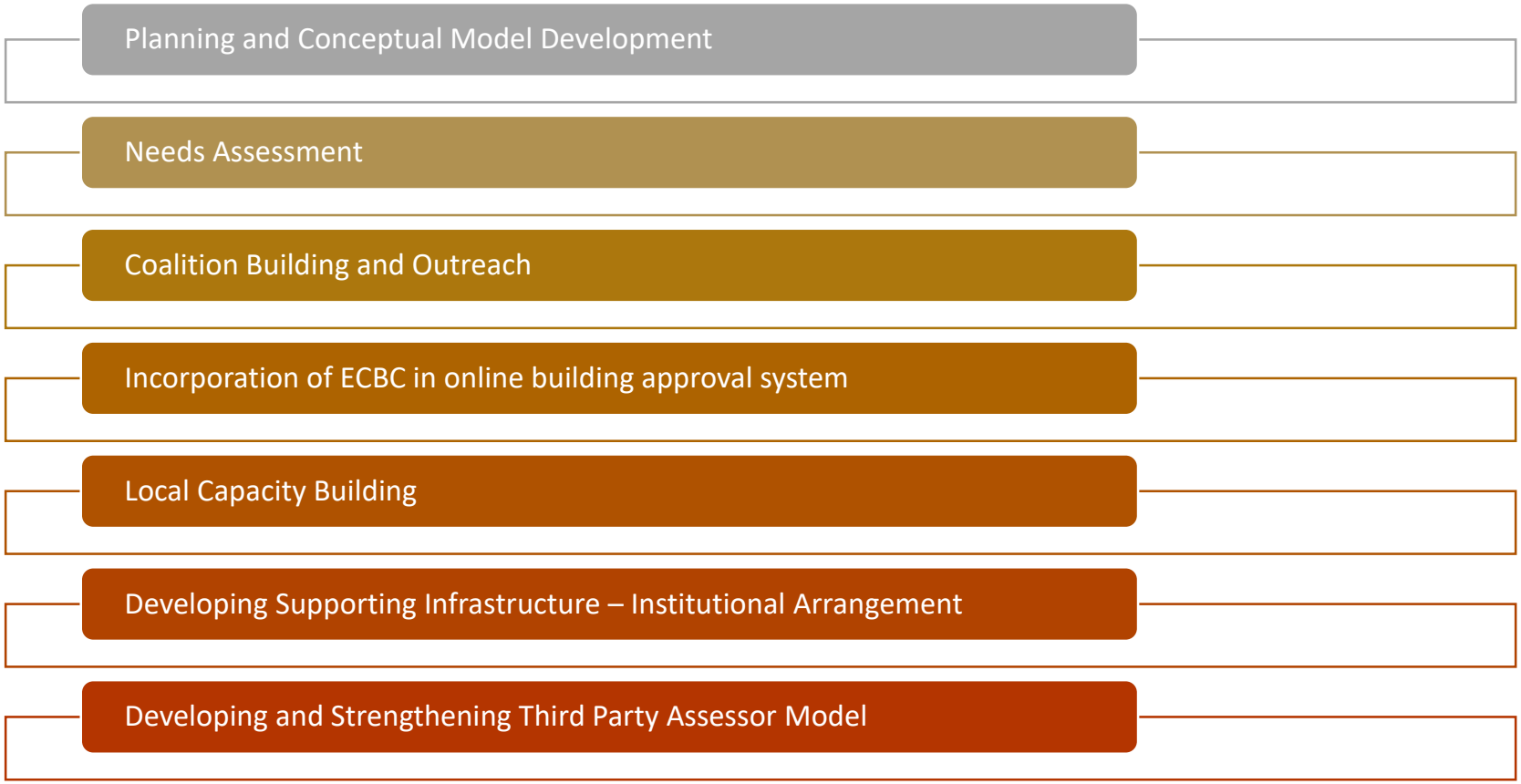
ECBC – Key Features

- Applicable for all commercial buildings with connected load of 100kW or greater/ contract demand of 120kVA or greater.
- ECBC focuses and set standards on Building Envelope, Lighting, Heating, ventilation and Air conditioning (HVAC) System, Service Water heating and electrical, renewable energy systems
- Introduction of three levels of compliance: ECBC (mandatory), ECBC Plus and Super ECBC (voluntary).
- Daylighting requirements are mandatory to follow.
- Targeted for net zero energy buildings in future

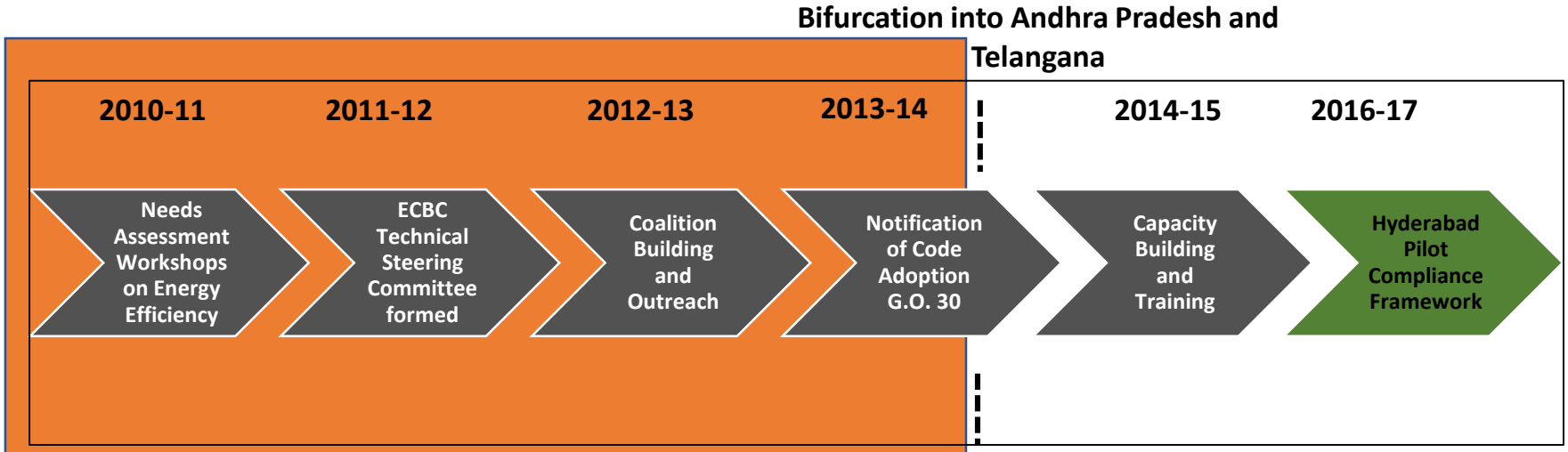
ECBC – Applicability and Approaches



Seven Steps of Energy Conservation Building Code Adoption in AP and Telangana – A Case



ECBC in Andhra Pradesh and Telangana



- Extensive stakeholder consultations and awareness building about ECBC
- Formation of a steering committee and a technical committee to inform process and adapt ECBC to local bylaws
- Notification of ECBC through amendment to G.O.M.S.168 i.e., G.O.M.S. 30 dt. 28.01.2014.

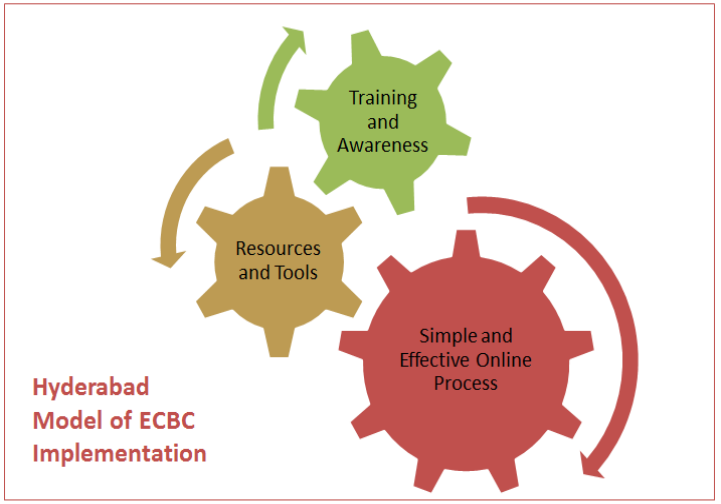
- Implementation of ECBC in the state of Andhra Pradesh and newly formed Telangana
- Empanelment of architects - completed
- Training completed – more than 750 government officials, real estate developers and architects in AP and Telangana

Support Action

- Regular conduct of Technical Committee (set by GO 1328) meetings to review ECBC implementation – **Top level commitment**

- Released easy TS-ECBC Guidelines and Frequently Asked Questions - **Supportive Resources**

- Strengthen the implementation framework by incorporation of ECBC in Online Building Approval System – **Ease of Compliance**

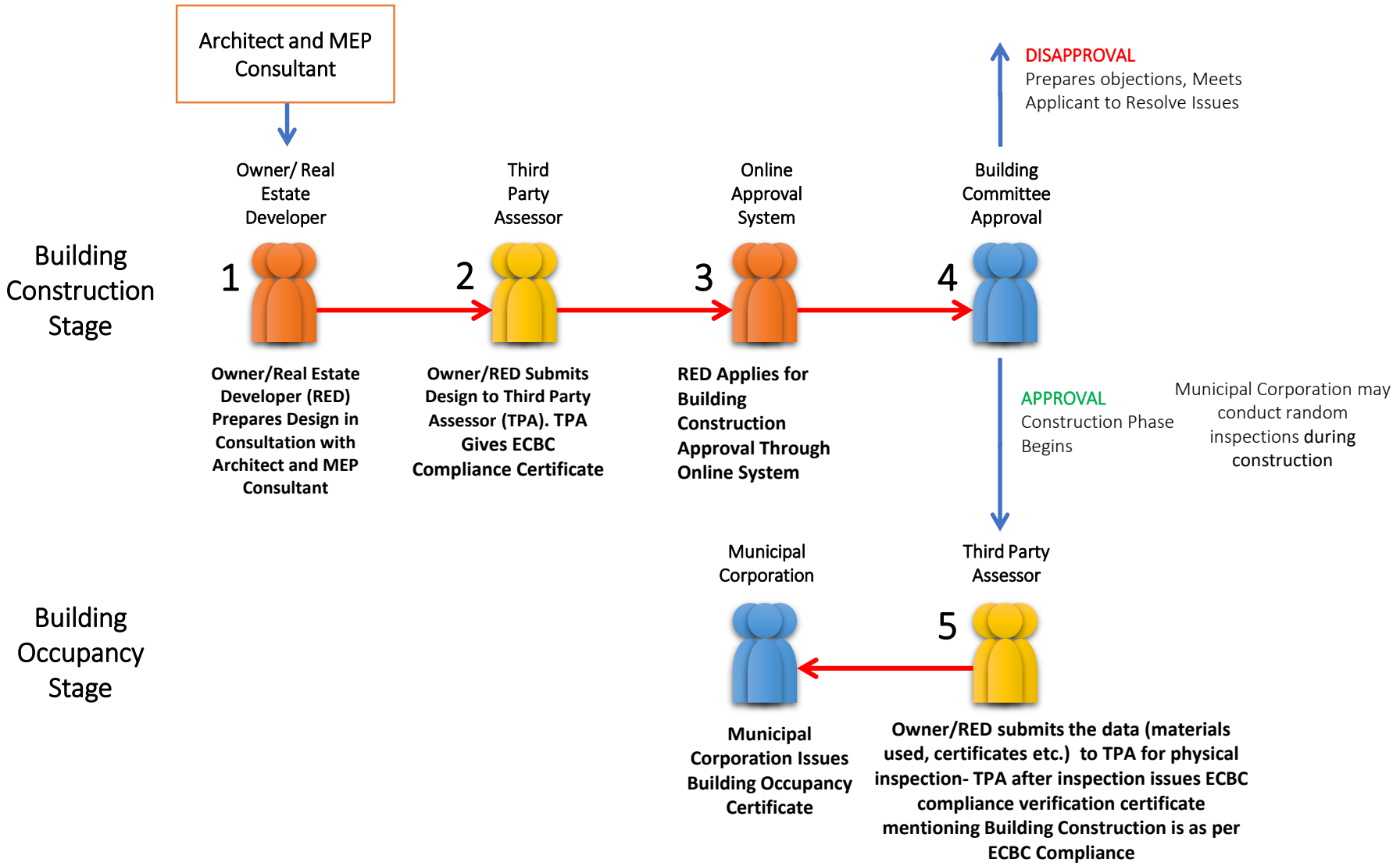



Frequently Asked Questions
ONLINE COMPLIANCE SYSTEM FOR ENERGY CONSERVATION BUILDING CODE (ECBC) FOR HYDERABAD

Frequently Asked Questions Online Compliance System for Energy Conservation Building Code (ECBC) for Hyderabad

Http://www.ghmc.gov.in/tender%20pdfs/ECBC_FAQs.pdf

ECBC Implementation Framework



7 Steps to develop ECBC compliance through institutional framework - Learning from AP and TS Model

Steps	Particulars	Activities	Key Stakeholders
Planning, Conceptual Model Development and Needs Assessment	Formation of high level committee for ECBC implementation	▪ Issuing the Government Order at State Level ▪ Review of ECBC compliance through departments	▪ Chief Secretary ▪ MAUD and Energy ▪ Institutional Partners ▪ Associations of REDs, MEPs, Architects
Coalition Building and Outreach	Stakeholder engagement and development of supportive resources	▪ Developing content, guidelines and FAQs	▪ ULBs, SDA, Institutional partners, Associations of different stakeholders
Develop Third Party Assessor (TPA) compliance monitoring model	Strengthening Third Party Assessor (TPA) Model	▪ Floating of RFP ▪ Selection and Empanelment of TPAs ▪ Issue of licenses	▪ ULBs ▪ Trained ECBC professionals

7 Steps to develop ECBC compliance through institutional framework - Learning from AP and TS Model…

Steps	Particulars	Activities	Key Stakeholders
Incorporating ECBC compliance in Building Approval Process	Enforcement of ECBC by Building Approval Committee	▪ Application format for building construction approval by MAUD ▪ Changing formats of building permit orders ▪ Occupancy certificates showcasing Compliance	▪ Building Construction Approval Committee
Capacity Development	Massive Capacity Building Program for Stakeholders	▪ 1-2 day awareness programs for officials ▪ 5-day certificate program to create pool of ECBC experts ▪ Training of trainers ▪ Incorporate ECBC in syllabus of Architecture and Facility Services and Planning Engineering	▪ ASCI, IIIT-Hyderabad, NRDC ▪ Jawaharlal Nehru Fine Arts University

7 Steps to develop ECBC compliance through institutional framework - Learning from AP and TS Model….

Steps	Particulars	Activities	Key Stakeholders
Incorporation of ECBC in Online Compliance System	Updating system to include ECBC in building application workflow	▪ Incorporating ECBC in existing building construction approval process	▪ ULBs ▪ Building Construction Approval Committee ▪ DTCPO
Next Steps	Effective Monitoring and Verification Tool Development (*to be developed*)	▪ Development of data framework for state level ECBC compliance and linking the framework to validating EMIS ▪ Linking online building construction approval with Energy Management Information System with BEE ▪ Introduce and advance a critical Building Energy Regulation and Disclosure policy (BER&D)in the state.	▪ State Government, MAUD, Energy Department, SDA, BEE and other institutional partners

S.no	State/UT	ECBC Amendment	ECBC Notification	Notification in state bye-laws	Notification at Municipalities	Enforcement	Schedule of Rates -PWD	ECBC Cell	Training & Capacity Development	Energy Simulation Software
1	Andhra Pradesh	✓	✓	✓	✓	✓		✓	✓	*
2	Arunachal Pradesh	✓						✓	✓	
3	Assam	✓						✓		
4	Bihar	✓						✓		*
5	Chandigarh UT							✓		
6	Chhattisgarh	✓						✓	✓	✓
7	NCT of Delhi	✓						✓		*
8	Goa							✓		
9	Gujarat	✓						✓		
10	Haryana	✓	✓	✓				✓		✓
11	Himachal Pradesh	✓						✓		
12	Jammu and Kashmir									
13	Jharkhand							✓		
14	Karnataka	✓	✓				✓	✓	✓	✓
15	Kerala	✓						✓	✓	*
16	Madhya Pradesh	✓						✓		*
17	Maharashtra	✓						✓	✓	*

S.no	State/UT	ECBC Amendment	ECBC Notification	Notification in bye-laws	Notification at Municipalities	Enforcement	Schedule or Rates-PWD	ECBC Cell	Training & Capacity Development	Energy Simulation Software
18	Manipur							✓		
19	Meghalaya							✓		
20	Mizoram							✓		
21	Nagaland							✓		
22	Odisha	✓	✓					✓		*
23	Puducherry UT	✓	✓					✓		
24	Punjab	✓	✓					✓	✓	✓
25	Rajasthan	✓	✓					✓		
26	Sikkim							✓		
27	Tamil Nadu	✓						✓		
28	**Telangana**	✓	✓	✓	✓	✓		✓	✓	✓
29	Tripura							✓		
30	Uttar Pradesh	✓						✓		✓
31	Uttarakhand	✓	✓					✓		
32	West Bengal	✓	✓					✓		

Few Screenshots to understand the process of ECBC compliance implementation in Greater Hyderabad Municipal Corporation

GHMC Building Application- ECBC incorporation

- Provisions for ECBC compliance documents (compliance report) in Part I, table E, point 33 of building application form of GHMC as shown below

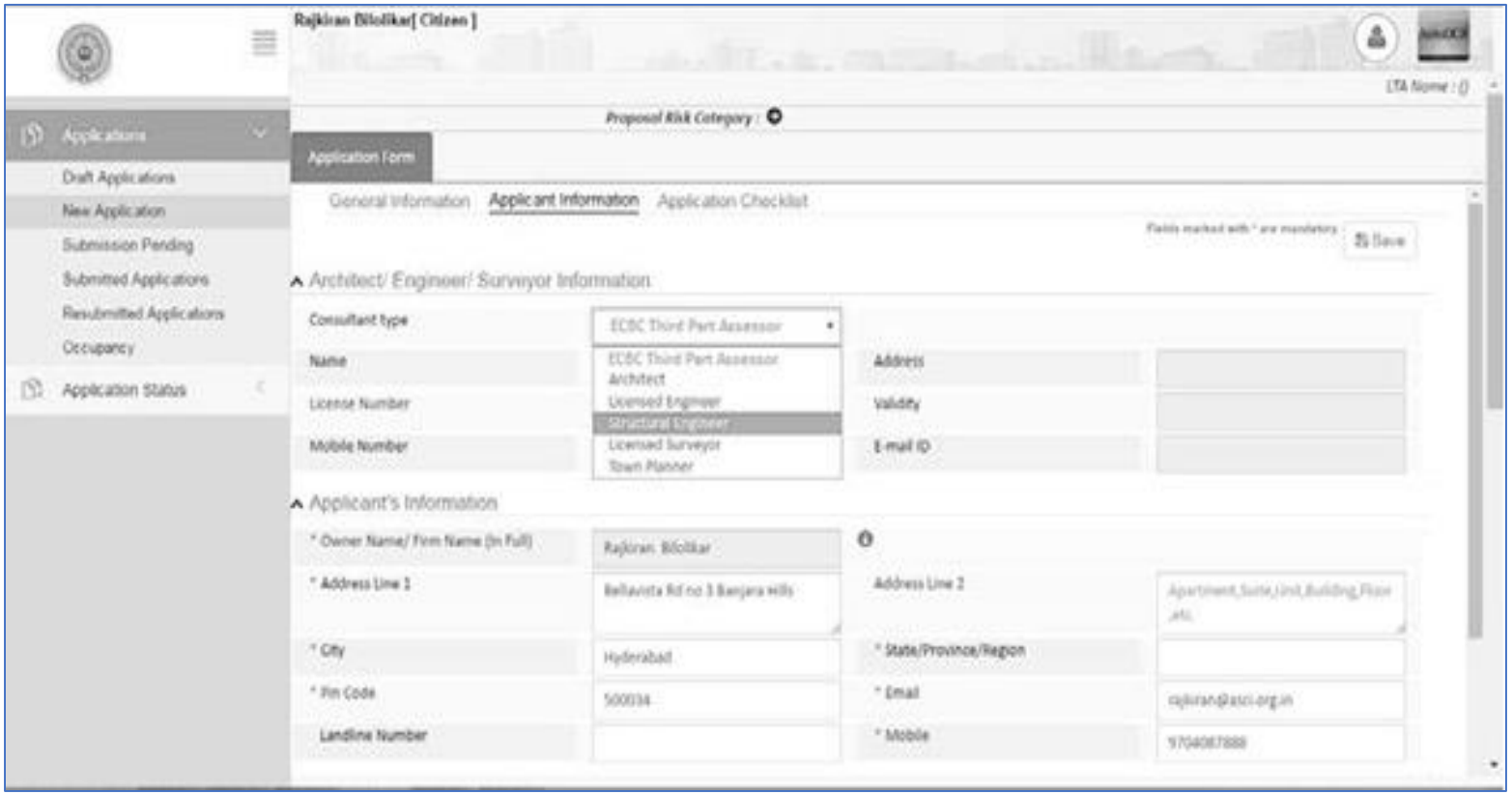
25	Structural Drawings *(G.O.Ms.No.541 MA, dt:17.11.2000)*			
26	Undertaking Rs.100/- Non judicial stamp paper duly stating whether the construction is taken up by the owner. *(G.O.Ms.No.541 MA, dt:17.11.2000)*			
27	Declaration-Cum-Undertaking on Rs.100/- Non Judicial Stamp Paper from the Owner and Builder. *(G.O.Ms.No.541 MA, dt:17.11.2000)*			
28	Undertaking on Rs.100/- NJS by Owner, Builder, Architect, Structural Engineer (Duly Notarised). *(G.O.Ms.No.541 MA, dt:17.11.2000)*			
29	Undertaking on Rs.100/- NJS paper jointly by owner and Builder seeking Occupancy Certificate. (Duly Notarised). *(G.O.Ms.No.541 MA, dt:17.11.2000)*			
30	Joint undertaking on Rs.100/- Non Judicial Stamp paper for not stocking Building materials on road margin not to enclose balconies, usage of parking, payment of special sanitation charges, garbage charges and not to increase number of units. *(G.O.Ms.No.541 MA, dt:17.11.2000)*			
31	Comprehensive Insurance Policy for 3 years *(G.O.Ms.No.541 MA, dt:17.11.2000)*			
32	Undertaking on Rs. 20/- NJS paper for handing over road widening portion wherever applicable.			
33	**ECBC compliance report issued by empanelled Third Party Assessor (as per *G.O.M.S. 30 MA&UD, dt 28.01.2014*)**			

GHMC Building Application- ECBC incorporation

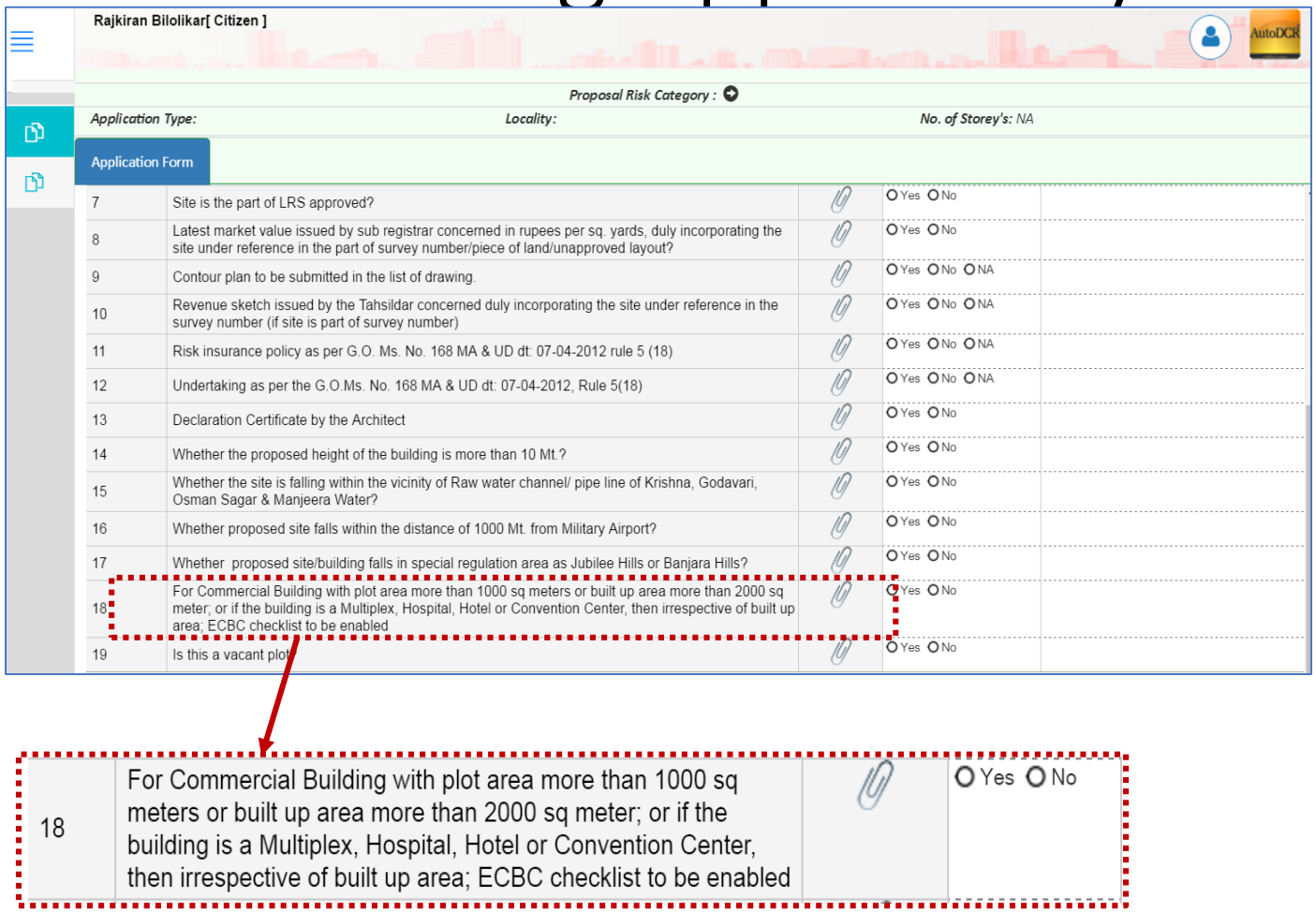
- Provisions for ECBC compliance certificate (issued by empanelled TPA) in Part III table A, point 13 of building application form of GHMC as shown below

6	NOC from AAI, wherever applicable			
7	NOC Fire Services & Emergency Department, wherever required			
8	Structural stability certificate issued by CE, GHMC			
9	NOC of Commissioner of Police, wherever required			
10	NOC of Traffic Assessment Report from Traffic Police, wherever required			
11	NOC from Heritage Conservation Committee			
12	Report from Irrigation/Revenue Department in case of lands abut water bodies, Water courses & nalas			
13	**ECBC Compliance Certificate issued by Empanelled TPA**			

Incorporation of ECBC in GHMC online Building Approval System

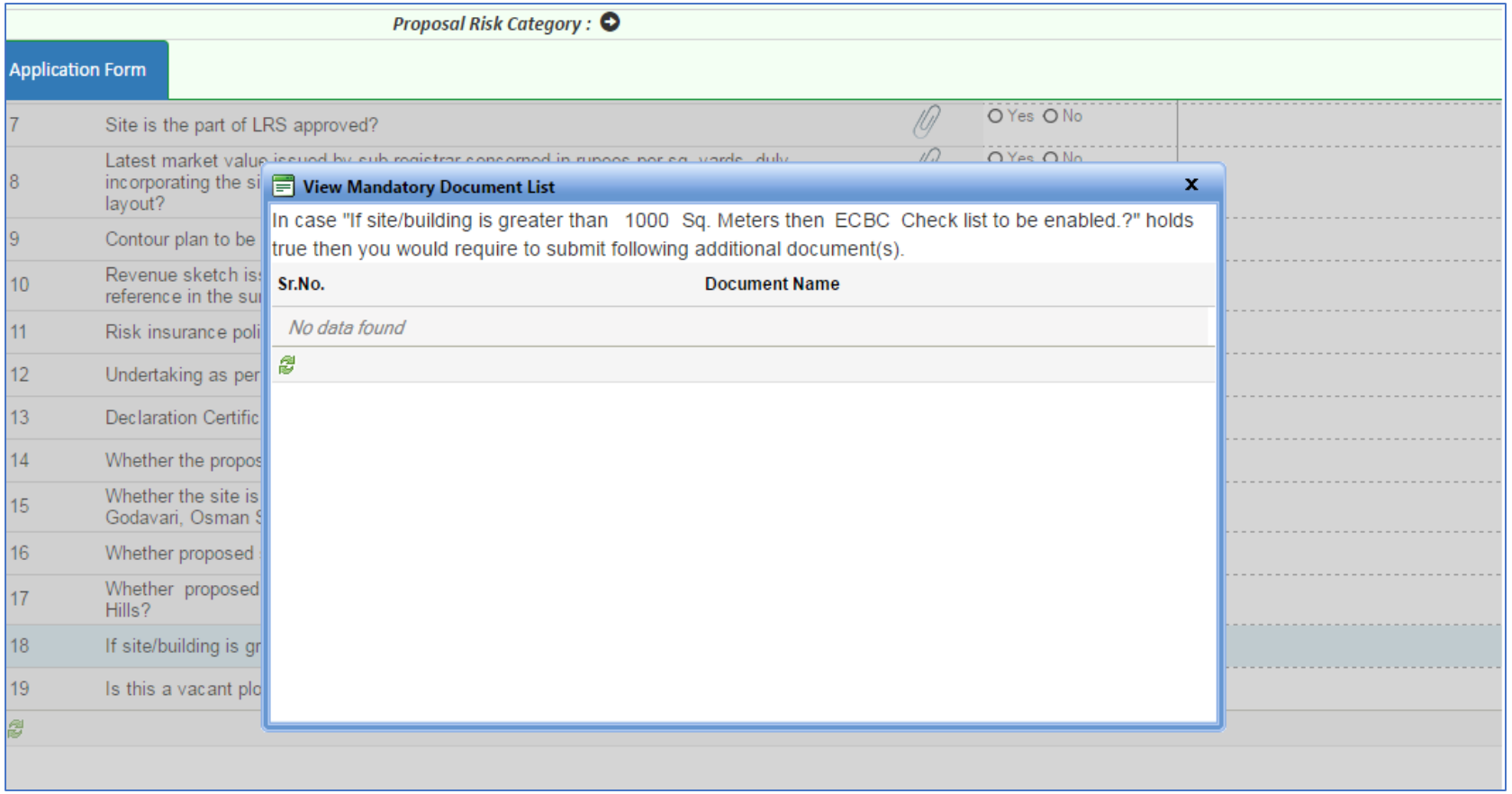


Incorporation of ECBC in GHMC online Building Approval System



18 For Commercial Building with plot area more than 1000 sq meters or built up area more than 2000 sq meter; or if the building is a Multiplex, Hospital, Hotel or Convention Center, then irrespective of built up area; ECBC checklist to be enabled Yes No

Incorporation of ECBC in GHMC online Building Approval System



Supportive Resources - http://ghmc1.ghmc.gov.in/index.asp

[Expression of Interest for Empanelment of Third Party Assessors for implementation of ECBC in Telangana](#)

[FAQs on Online Compliance System for ECBC](#)

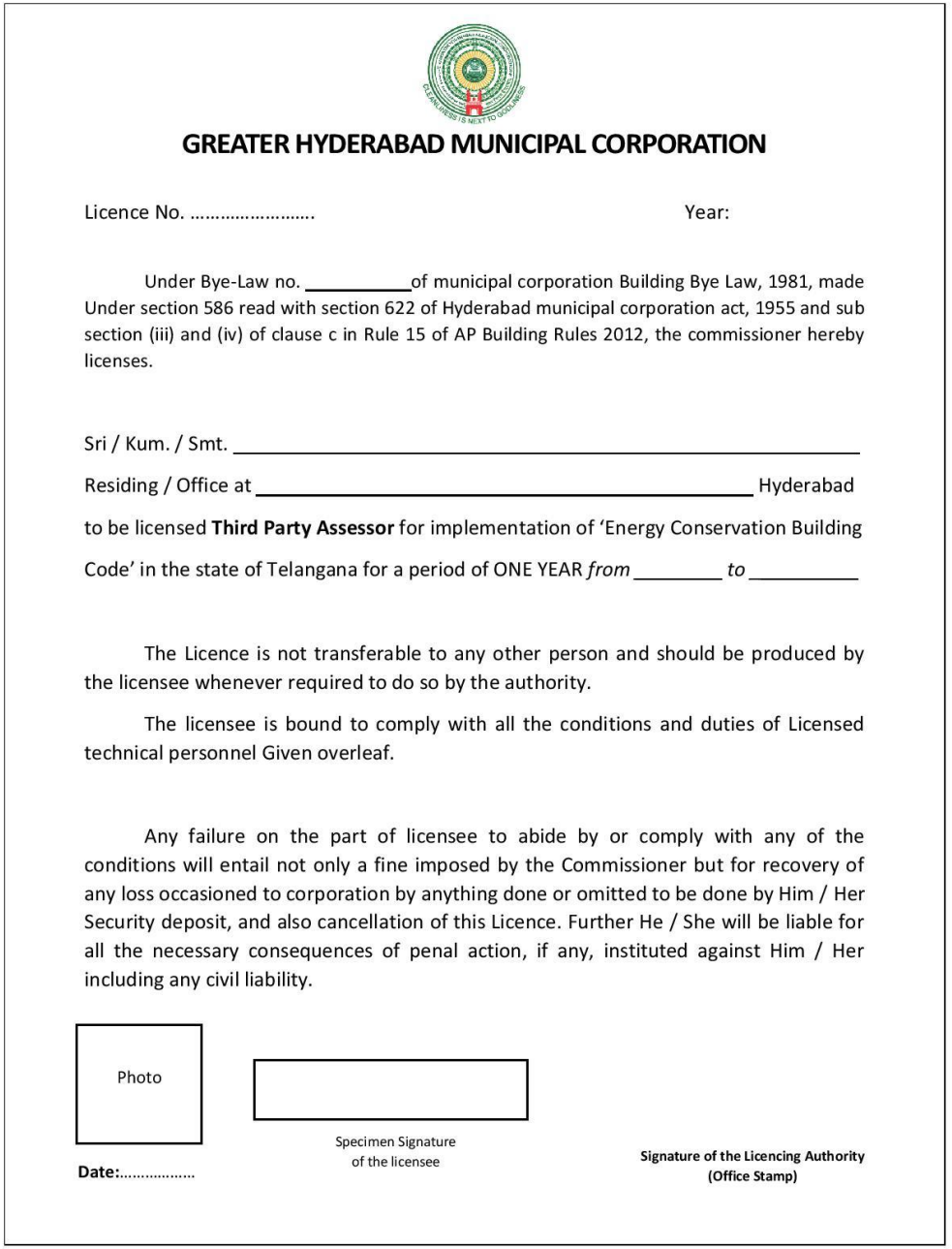
TPA License Format - Draft

Every empanelled Third Party Assessor shall possess the following License document.

- ✓ The license form specifies the name, address, license number and the term of the licensee with an official stamp from the GHMC.
- ✓ Each TPA will be assigned with a unique license number which will also be replicated in the Compliance Certificate.

Significance: The License enables the Third Party Assessor to scrutinize the building documents for ECBC compliance and issue the "ECBC Certificate".

It also enables the GHMC to monitor the TPAs



GREATER HYDERABAD MUNICIPAL CORPORATION

Licence No. ……. Year:

Under Bye-Law no. _____of municipal corporation Building Bye Law, 1981, made Under section 586 read with section 622 of Hyderabad municipal corporation act, 1955 and sub section (iii) and (iv) of clause c in Rule 15 of AP Building Rules 2012, the commissioner hereby licenses.

Sri / Kum. / Smt. _____

Residing / Office at _____ Hyderabad

to be licensed **Third Party Assessor** for implementation of 'Energy Conservation Building Code' in the state of Telangana for a period of ONE YEAR *from* _____ *to* _____

The Licence is not transferable to any other person and should be produced by the licensee whenever required to do so by the authority.

The licensee is bound to comply with all the conditions and duties of Licensed technical personnel Given overleaf.

Any failure on the part of licensee to abide by or comply with any of the conditions will entail not only a fine imposed by the Commissioner but for recovery of any loss occasioned to corporation by anything done or omitted to be done by Him / Her Security deposit, and also cancellation of this Licence. Further He / She will be liable for all the necessary consequences of penal action, if any, instituted against Him / Her including any civil liability.

Photo

Specimen Signature of the licensee

Date:……

Signature of the Licencing Authority (Office Stamp)

Compliance Certificate
Design Stage

Key Features

- ✓ Certificate with display of percentage savings at design stage
- ✓ Star rating awarded on basis of percentage of savings
- ✓ Compliance method used
- ✓ General and technical information about building

Significance: Increases the marketability of the building at pre-construction stage

Compliance Certificate
Occupancy Stage

Key Features

- ✓ Post construction certificate
- ✓ Star rating awarded on basis of percentage of savings

Significance: Mandatory for obtaining occupancy certificate.

Thank You

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